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PATENT

Amendments to the Drawings

The attached sheets of drawings includes changes to Figs. 3, 6, and 7. The sheets, which include Figs. 1-7, replace the original sheets including Figs. 1-7.

Attachment: Replacement Sheets

REMARKS

Title, Specification, and Drawings

The title is changed in accordance with the office action to "Safety System and Method Utilizing Multiple Laser Beams for an Industrial Machine."

The drawings were objected to under 37 CFR 1.83(a). Applicant notes that Figures 3, 6, and 7 show the tool 25 and tool tip 27 of an industrial press. However, if the Examiner determines that an additional drawing of an industrial press is required, Applicant would be happy to comply. Figs. 6 and 7 were objected to under 37 CFR 1.121(d) because of insufficient quality. Applicant presumes that the objection is to the dark block laser 28 image. Thus, Applicant has amended the drawings to show cross-hatched views.

Applicant has also amended Fig. 3 to include reference numeral 8. Reference numeral 8 refers to a speed control point between the first laser beam 7a and the second laser beam 7b, which is supported by the specification, such as at page 12, lines 23-29. Also, in the specification, "speed control point" has been amended to "speed control point 8" to be consistent with Fig. 3. No new matter is added by this amendment.

Claims

Claims 1-57 are currently pending. Claims 1-15, 17-19, 26, 28, 32, 34-40, 43-51, and 53-57 are rejected under Section 103 (a) as being unpatentable over Fiessler (US 6,752,253) (hereinafter referred to as the "253 patent"), or over Fiessler in view of DeCoi (US 6,124,586), Harrison et al. (US 3,750,436), Fiessler (US 6,677,574), or Petrohilos et al. (US 4,007,992). Claims 16, 20-25, 29-31, 33, 41, 42, and 52 have been recognized as containing allowable subject matter, but have been rejected to.

Claims 1, 8, 15, 32, and 39 are amended in accordance with the office action to overcome the Examiner's objections to informalities. Claims 17 and 34 are amended to overcome the Examiner's rejection based on insufficient antecedent basis. And thus, dependent claims 18, 19, 35, and 36 no longer inherit the indefiniteness of claims 17 or 34. Further, claims 17, 18, and 19 are amended to more clearly describe the limitations of the claims. Support for these claims may be found in the drawings as well as in the description thereof. These amendments do not narrow the scope of any limitation.

Claim Rejections under 35 U.S.C. § 103

The only rejections of independent claims 1 and 32 are based on obviousness over Fiessler (US 6,752,253). The only rejection of independent claim 53 is based on obviousness over Fiessler (US 6,752,253) in view of Petrohilos.

Applicant respectfully submits that Fiessler (US 6,752,253) does not teach or suggest all of the claim elements of claim 1 or claim 32. Also, Applicant respectfully submits that Fiessler (US 6,752,253) in combination with Petrohilos does not teach or suggest all of the claim elements of claim 53.

A description of the prior art may be helpful in placing the claimed invention in context. Typically, in conventional single laser safety systems, the spacing between the safety laser beam traveling ahead of the leading edge of the tool is equal to the distance that the tool requires to be able to slow to a closing speed (usually, and for purposes of illustration, about 10 mm/s) and stop. The spacing of the single safety laser beam can, for example (an in accordance with the present illustration), be set to about 9 mm ahead of the leading edge of the tool if the tool can slow to a closing speed and stop in less than 9mm, for example, about 8.5 mm.

To increase production efficiencies, it would be advantageous to have a press brake that can operate with tools traveling at speeds higher than the typical 150 mm/s used with prior art press brakes. In order to achieve these higher tool speeds with prior art single beam safety systems, the laser beam would need to be located further ahead of the leading edge of the tool to provide an acceptable stopping distance for the tool. This solution, however, requires that the tool to slow down to a cool or closing speed over a greater distance than normal, thereby lengthening the distance and time that the tool must travel at the cool or closing speed. The multiple beam safety system according to the present invention provides a deceleration zone that allows the tool to decelerate from increased speeds of, for illustration, about 200 – 220 mm/s to an acceptable cool speed. The deceleration zone of the present (that is, claimed) invention allows a press brake to operate at higher speeds that result in shorter production times.

Claim 1

Claim 1 includes a plurality of parallel continuous planar laser beams, and a controller for stopping or preventing motion of a moveable section of an industrial press when a beam

receiver detects that at least one of the beams has been interrupted by an object. Further, the controller decelerates the moveable section from a first speed to a second speed within a deceleration zone defined by a first planar beam passing a speed control point and a second planar beam passing the same speed control point.

The defined deceleration zone may allow the moveable section of the industrial press to move at maximum operational speed until the first planar beam passes a speed control point and the moveable section is decelerated. Once the second planar laser beam passes the speed control point, the moveable section can be moved to a final crawl speed for bending. The present invention allows for more precise control of the speed of the moveable section, with the blade initially decelerated and then moved to a final crawl speed. This helps reduce the overall production cycle of the machine.

The 253 patent seeks to improve on problems and limitations found in an earlier Fiessler system (DE 19717299) (hereinafter referred to as the “299 patent”). The 299 patent describes a system with two beams separated by a safety distance, a distance in which the tool (*i.e.* moveable section) must stop. When the lower beam of the 299 patent is broken, the safety system stops the moveable section. The upper beam of the 299 patent, however, is not part of a safety system. The upper beam is used to measure the distance between the tool and lower beam to set the safety distance. The upper beam is used to calibrate the safety system by raising the tool until the upper beam is interrupted, thereby automatically setting the safety distance and calibrating the system. During operation of the machine, the upper beam remains inactive. Therefore, it follows that the upper beam (adjacent the tool) of the 299 patent is distinct from the safety system and is not a safety beam.

The 253 patent provides movement of the light beam guard means until the beam touches the moveable section (*i.e.* tool), and then moves the light beam a predetermined distance in the opposite direction (*i.e.* away from the tool), so that the displacement or distance traveled sets the safety distance. The second movement of the light beam in the opposite direction (*i.e.* away from the tool) may be measured by an electrical and/or control means to set the safety distance (*see* Col. 1, lines 49-65). As shown in Figure 1 of the 253 patent, the guides 15 and 16 and the respective laser source 17 and receiver 18 are adjusted up or down in a direction “B” relative to the tool by a control means 26 using the module 27. This adjustment sets the safety distance by first raising the laser beam to touch the tool 12

and then, the guides 15 and 16 are moved downward to set the safety distance between the laser beam and the tool tip.

If a greater overrun or breaking distance is required, an additional array of beams can be employed. Importantly, however, “the photo electric detector 20 employed for setting the safety distance is in this case arranged in the space nearest to the top tool 10.” That is, the additional array of beams is merely a replication of the first beam or beams 20 to 22, providing merely an extended stopping distance. There is no interaction between the first set of beams and the second set of beams.

Essentially, the 253 patent teaches the adjustment of the safety beam to automatically calibrate the system. This avoids the need for a feeler beam used to set a safety distance as taught by the 299 patent or the manual shim safety distance setting method, which can lead to injury to a person holding a shim (*see* Col. 1, lines 25-46). The 253 patent seeks to address these issues in the prior art by providing an automatically adjustable beam that is moved toward the tool tip and moved a predetermined safety distance away from the tool tip once the beam touches the tool tip.

Accordingly, the 253 patent does not teach or suggest all of the elements of claim 1. In particular, inter alia:

1. The 253 patent does not teach or suggest the use of “continuous planar beams” of the laser. The broad planar beams of the present (that is, claimed) invention avoid gaps or spaces between individual beams, such as the gaps between the individual beams 20, 21, and 22 shown in Figure 2 of the 253 patent.
2. The 253 patent does not teach or suggest (as noted by the Examiner) the deceleration of the moveable section within a deceleration zone defined between a first point at which a first planar beam passed a speed control point and second point at which a second planar beam passes the same speed control point.

Further, Applicant respectfully submits that there is no teaching or suggestion in the 253 patent that makes the invention, as defined in claim 1, obvious to a person skilled in the art based on the automatic calibration system described in the 253 patent.

Claim 32

Claim 32 includes, among other things:

- “a continuous beam of rectilinear cross-section” having “a proximate and distal face relative to a leading edge of the moveable section;”
- where the moveable section of the industrial press decelerates “from a first speed to a second speed within a deceleration zone”; and
- where the deceleration zone is “defined between a first point at which the proximate face passes a speed control point and a second point at which the distal face passes the same speed control point.”

The 253 patent does not teach or suggest any of the elements of claim 32 mentioned above. For example, the 253 patent does not disclose the rectilinear safety beam that is recited in claim 32. And there is nothing in the 253 patent to suggest to a person skilled in the art to adapt the system of the 253 patent to use such beam. In fact, the claimed beam would interfere with the automatic safety distance setting arrangement of the 253 patent because of the additional depth or thickness of a rectilinear (broad block) beam as compared to the pencil-type beams of the 253 patent. The additional thickness of a broad block beam would disadvantageously alter the safety distance to be set by the system in the 253 patent, which could lead to erroneous stopping distances and potentially faulty operating conditions.

Accordingly, Applicant respectfully submits that there is no teaching or suggestion in the 253 patent to a person skilled in the art to adapt the system of the 253 to use a broad block rectilinear safety beam and a deceleration zone as defined in claim 32.

Claim 53

Applicant respectfully disagrees with the Examiner’s assertion that claim 53 is obvious based on the 253 patent in combination with Petrohilos (US 4,007,992) (hereinafter referred to as the “992 patent”). The invention defined in claim 53 provides a method of converging the planar beam along an axis parallel to the movement of the moveable section until the leading edge interrupts the planar beam, and subsequently diverging the planar beam away from the leading edge along the axis by a predetermined distance, the predetermined distance being set as the safety distance. The combination of the 253 and 992 patents does not teach or suggest the claim elements mentioned above, and thus, fails to render claim 53 obvious.

Further, neither the 253 patent, nor the 992 patent provides any motivation to combine the patents to arrive at the invention defined in claim 53. The 992 patent seeks to overcome the problems that narrow collimated beams have with sensing irregularities of foreign particles when measuring the size or dimensions of an object. Because a single pencil beam may be occluded by a foreign particle and not sensed, a larger dimension than the actual dimension of an object may be measured. The 992 patent, therefore, uses a lens arrangement to widen the beam so that the major portion of the beam bypasses the foreign particles and thus, the correct dimension is measured. The 992 patent is directed to the measurement of the dimensions of an object and to the avoidance of measurements that take into account foreign particles and irregularities in the object. The teachings of the 253 patent and the 992 patent are too disparate for a person skilled in the art to be motivated to combine the patents and arrive at the invention defined in claim 53.

CONCLUSION

For the reasons set out above, it is respectfully submitted that independent claims 1, 32, and 53 are in fact patentably distinguishable over the cited prior art. Claims 2-15, 17-19, 26, 28, 34-40, 43-51, and 54-57 are all dependent directly or indirectly on claims 1, 32, and 53 and for this reason, it is respectfully submitted that they too are patentably distinguishable over the cited prior art.

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/Harold H. Fullmer/
Harold H. Fullmer
Registration No. 42,560

Woodcock Washburn LLP
Cira Centre
2929 Arch Street, 12th Floor
Philadelphia, PA 19104-2891
Telephone: (215) 568-3100
Facsimile: (215) 568-3439